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# Cigarettes and Other Nicotine Products

Nicotine is one of the most heavily used addictive drugs in the United States. In 2002, 30 percent of the U.S. population 12 and older—71.5 million people—used tobacco at least once in the month prior to being interviewed. This figure includes 3.8 million young people age 12 to 17; 14 million people age 18 to 25; and 53.7 million age 26 and older.* Most of them smoked cigarettes.

Cigarette smoking has been the most popular method of taking nicotine since the beginning of the 20th century. In 1989, the U.S. Surgeon General issued a report that concluded that cigarettes and other forms of tobacco, such as cigars, pipe tobacco, and chewing tobacco, are addictive and that nicotine is the drug in tobacco that causes addiction. In addition, the report determined that smoking was a major cause of stroke and the third leading cause of death in the United States. Statistics from the Centers for Disease Control and Prevention indicate that tobacco use remains the leading preventable cause of death in the United States, causing more than 440,000 deaths each year and resulting in an annual cost of more than $75 billion in direct medical costs. (See www.cdc.gov/tobacco/issue.htm).

## *Health Hazards*

Nicotine is highly addictive. It is both a stimulant and a sedative to the central nervous system. The ingestion of nicotine results in an almost immediate "kick" because it causes a discharge of epinephrine from the adrenal cortex. This stimulates the central nervous system, and other endocrine glands, which causes a sudden release of glucose. Stimulation is then followed by depression and fatigue, leading the abuser to seek more nicotine. Nicotine is absorbed readily from tobacco smoke in the lungs, and it does not matter whether the tobacco smoke is from cigarettes, cigars, or pipes.

Nicotine also is absorbed readily when tobacco is chewed. With regular use of tobacco, levels of nicotine accumulate in the body during the day and persist overnight. Thus, daily smokers or chewers are exposed to the effects of nicotine for 24 hours each day. Nicotine taken in by cigarette or cigar smoking takes only seconds to reach the brain but has a direct effect on the body for up to 30 minutes.

Research has shown that stress and anxiety affect nicotine tolerance and dependence. The stress hormone corticosterone

reduces the effects of nicotine; therefore, more nicotine must be consumed to achieve the same effect. This increases tolerance to nicotine and leads to increased dependence. Studies in animals have also shown that stress can directly cause relapse to nicotine self-administration after a period of abstinence.

Other studies have shown that animals cannot discriminate between the effects of nicotine and the effects of cocaine. Studies have also shown that nicotine self-administration sensitizes animals to self-administer cocaine more readily. Addiction to nicotine results in withdrawal symptoms when a person tries to stop smoking. For example, a study found that when chronic smokers were deprived of cigarettes for 24 hours, they had increased anger, hostility, and aggression, and loss of social cooperation. Persons suffering from withdrawal also take longer to regain emotional equilibrium following stress. During periods of abstinence and/or craving, smokers have shown impairment across a wide range of psychomotor and cognitive functions, such as language comprehension.

Women who smoke generally have earlier menopause. If women smoke cigarettes and also take oral contraceptives, they are more prone to cardiovascular and cerebrovascular diseases than are other smokers; this is especially true for women older than 30.

Pregnant women who smoke cigarettes run an increased risk of having stillborn or premature infants or infants with low birthweight. Children of women who smoked while pregnant have an increased risk for developing conduct disorders. National studies of mothers and daughters have also found that maternal smoking during pregnancy increased the probability that female children would smoke and would persist in smoking.

Adolescent smokeless tobacco users are more likely than nonusers to become cigarette smokers. Behavioral research is beginning to explain how social influences, such as observing adults or other peers smoking, affect whether adolescents begin to smoke cigarettes. Research has shown that teens are generally resistant to many kinds of anti-smoking messages.

In addition to nicotine, cigarette smoke is primarily composed of a dozen gases (mainly carbon monoxide) and tar. The tar in a cigarette, which varies from about 15 mg for a regular cigarette to 7 mg in a low-tar cigarette, exposes the user to a high expectancy rate of lung cancer, emphysema, and bronchial disorders.

The carbon monoxide in the smoke increases the chance of cardiovascular diseases. The Environmental Protection Agency has concluded that secondhand smoke causes lung cancer in adults and greatly increases the risk of respiratory illnesses in children and sudden infant death.

## Promising Research

Research has shown that nicotine, like cocaine, heroin, and marijuana, increases the level of the neurotransmitter dopamine, which affects the brain pathways that control reward and pleasure. Scientists now have pinpointed a particular molecule (the beta 2 (b2) subunit of the nicotine cholinergic receptor) as a critical component in nicotine addiction. Mice that lack this molecule fail to self-administer nicotine, implying that without the b2 molecule, the mice do not experience the positive reinforcing properties of nicotine. This new finding identifies a potential site for targeting the development of anti-nicotine addiction medications.

Other new research found that individuals have greater resistance to nicotine addiction if they have a genetic variant that decreases the function of the enzyme CYP2A6. The decrease in CYP2A6 slows the breakdown of nicotine and protects individuals against nicotine addiction. Understanding the role of this enzyme in nicotine addiction gives a new target for developing more effective medications to help people stop smoking. Medications might be developed that can inhibit the function of CYP2A6, thus providing a new approach to preventing and treating nicotine addiction.

Another study found dramatic changes in the brain's pleasure circuits during withdrawal from chronic nicotine use. These changes are comparable in magnitude and duration to similar changes observed during the withdrawal from other abused drugs such as cocaine, opiates, amphetamines, and alcohol. Scientists found significant decreases in the sensitivity of the brains of laboratory rats to pleasurable stimulation after nicotine administration was abruptly stopped. These changes lasted several days and may correspond to the anxiety and depression experienced by humans for several days after quitting smoking "cold turkey." The results of this research may help in the development of better treatments for the withdrawal symptoms that may interfere with individual attempts to quit smoking.

## Treatment

Studies have shown that pharmacological treatment combined with behavioral treatment, including psychological support and skills training to overcome high-risk situations, results in some of the highest long-term abstinence rates. Generally, rates of relapse for smoking cessation are highest in the first few weeks and months and diminish considerably after about 3 months.

Behavioral economic studies find that alternative rewards and reinforcers can reduce cigarette use. One study found that the greatest reductions in cigarette use were achieved when smoking cost

was increased in combination with the presence of alternative recreational activities.

Nicotine chewing gum is one medication approved by the Food and Drug Administration (FDA) for the treatment of nicotine dependence. Nicotine in this form acts as a nicotine replacement to help smokers quit the smoking habit. The success rates for smoking cessation treatment with nicotine chewing gum vary considerably across studies, but evidence suggests that it is a safe means of facilitating smoking cessation if chewed according to instructions and restricted to patients who are under medical supervision.

Another approach to smoking cessation is the nicotine transdermal patch, a skin patch that delivers a relatively constant amount of nicotine to the person wearing it. A research team at NIDA's Division of Intramural Research studied the safety, mechanism of action, and abuse liability of the patch that was consequently approved by FDA. Both nicotine gum and the nicotine patch, as well as other nicotine replacements such as sprays and inhalers, are used to help people fully quit smoking by reducing withdrawal symptoms and preventing relapse while undergoing behavioral treatment.

Another tool in treating nicotine addiction is a medication that goes by the trademark Zyban. This is not a nicotine replacement, as are the gum and patch. Rather, this works on other areas of the brain, and its effectiveness is in helping to make controllable nicotine craving or thoughts about cigarette use in people trying to quit.

## Extent of Use

### 2002 Monitoring the Future Study (MTF)**

Despite the demonstrated health risk associated with smoking, young Americans continue to smoke. However, past-month smoking rates among high school students are declining from peaks reached in 1996 for 8th-graders (21.0 percent) and 10th-graders (30.4 percent) and in 1997 for seniors (36.5 percent). In 2002, rates reached the lowest levels ever reported by MTF; 10.7 percent of 8th-graders, 17.7 percent of 10th-graders, and 26.7 percent of high school seniors reported smoking during the month preceding their response to the survey.

The steady decrease in smoking rates among young Americans corresponds to several years in which increased proportions of teens said they believe there is a "great" health risk associated with cigarette smoking and expressed disapproval of "pack-a-day" smokers. In 2002, roughly 60 percent of 10th- and 12th-graders and 64 percent of 8th-graders agreed with the statement, "I think becoming a smoker reflects poor judgment."***

## Other Information Sources

For additional information on nicotine, please refer to the following sources on NIDA's Web site, **www.drugabuse.gov**:

Nicotine Addiction—*Research Report* Series
The Brain's Response to Nicotine—*Mind over Matter* Series

Various issues of *NIDA NOTES* (search by "nicotine" or "smoking")

For more information on how to quit smoking, please visit the Tobacco Information and Prevention Source (TIPS) Web site of the Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, at **www.cdc.gov/tobacco**.

* These findings are from the 2002 National Survey on Drug Use and Health, produced by HHS's Substance Abuse and Mental Health Services Administration. The survey is based on interviews with 68,126 respondents who were interviewed in their homes. The interviews represent 98 percent of the U.S. population age 12 and older. Not included in the survey are persons in the active military, in prisons, or other institutionalized populations, or who are homeless. Findings from the 2002 National Survey on Drug Use and Health are available online at www.DrugAbuseStatistics.samhsa.gov.

** Conducted annually since 1975, MTF assesses drug use and attitudes among 8th-, 10th-, and 12th-graders, college students, and young adults nationwide. The survey is conducted by the University of Michigan's Institute for Social Research and is funded by NIDA. Copies of the latest published survey are available from the National Clearinghouse for Alcohol and Drug Information at 1-800-729-6686 or may be downloaded from www.monitoringthefuture.org.

*** LD Johnston, PM O'Malley, JG Bachman. (December 16, 2002). *Teen smoking declines sharply in 2002, more than offsetting large increases in the early 1990s*. University of Michigan News and Information Services: Ann Arbor, MI. [Online]. Available: www.monitoringthefuture.org; accessed 09/25/03.

Revised 10/6/03

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